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INSTITUTE OF GAS TECHNOLOGY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Alberta Gas

Smith, A. Q. ALBERTA: RICH IN NATURAL GAS. *Gas Age*, 118, 21-25, 55, 56 (1956) Aug. 9.

This Canadian province is rapidly becoming an industrial giant, due principally to the presence of enormous oil and natural gas reserves. All gas in southern Alberta is sour, requiring treatment before distribution, and considerable quantities of sulfur are being recovered in the sweetening process. Manufacturing includes sulfur, cement, valves and fittings, and liquid and solid fertilizers. B. E. Eakin

Crop Drying Market

Sipchen, R. J. and Abell, C. CROP DRYING; FOR FARMERS, A NEW ERA: FOR LPG, A MAJOR MARKET. *Butane-Propane News*, 18, 27-33 (1956) August.

Artificial crop drying is not a new subject, but it is a tremendous undeveloped market for LP-gas. The equipment is available, and considerable knowledge of its use exists. Crop drying by controlled heat is being promoted by agricultural authorities, farm magazines and leading farm organizations. We believe it will be the next great contribution to the effective balancing of the LPG dealer's winter/summer load. H. L. Feldkirchner

Long Distance Supply

Hedrick, J. J. ECONOMICS OF LONG-DISTANCE GAS SUPPLY. *Gas Age*, 118, 37-42 (1956) September 6.

In a three-part discussion, the author presents here an expert analysis of the economics of long-distance gas supply, based on his experience with and knowledge of pipeline operation in the United States. He lists and discusses the economic considerations which must be given consideration when establishing and operating long-distance systems supplied with gas from any source. These factors remain the same, the author contends, regardless of type of gas transported, geographical location, or purpose of transportation, and should be the same whether the project is carried on by private enterprise or governmental authority. Part 1 describes the gas pipeline system as it exists in the United States. Part 2 discusses the economic requirements for the establishment of a long-distance gas supply system. Part 3 covers the economic requirements of the operation of such a system. (See also *Gas J.* (British), 287, 406, 411, 412 (1956) August 15.

Author's Abstract

Nuclear Power

Frye, J. H., Jr., and Gregg, J. A. ECONOMIC ATOMIC POWER DEPENDS ON MATERIALS OF CONSTRUCTION: POWER REACTOR PROGRAMS IN THE U. S. *Metal Progress*, 70, 92-6, 96B (1956) September.

Based on fuel and processing costs for the Materials Testing Reactor, in Idaho, which has operated reliably since 1952, the cost per kilowatt-hour of electricity produced from a highly enriched U-235 nuclear power reactor is estimated to range from 4.0 to 9.5 mills, itemized as follows:

Cost: U-235 Consumed	2.5 to 5.0 mills
Fabrication: fuel elements	1.0 to 2.0 mills
Chemical processing	0.5 to 2.5 mills
Total	4.0 to 9.5 mills

Compared to power costs from coal, which range from 2 to 5 mills per KWH electricity, U-235 fueled reactors will not be competitive with conventional fuels in much if not all of the U.S.A., and there is no reason to expect this situation to change in the near future. However, the most economical source of nuclear power would be through the use of U-233 fuel and a thorium breeder blanket which could replenish the U-233 as rapidly as it is consumed. Assuming a negligible cost for the thorium metal originally used, and taking the costs of fabrication and processing of U-233 fuel elements to be the same as in the case of U-235 fuel, it is estimated that nuclear power costs may range from 1.7 to 5.3 mills/KWH electricity. However, before such competitive costs for nuclear energy can be achieved, many problems yet unsolved in the fields of metallurgy and chemistry must be solved on a competitive basis. A summary of power reactor programs is given in tabular form, and the author concludes that the future of nuclear power in the United States rests primarily in the hands of metallurgists, ceramic engineers and chemists.

C. G. von Fredersdorff

Roboff, S. B. MATERIALS FOR NUCLEAR POWER. *Mining Eng.*, 8, 904-08 (1956) September.

The most important present materials for nuclear power include uranium-235, uranium-233 and plutonium as fuels; beryllium, graphite, light and heavy water as moderators; boron, cadmium, and hafnium as control elements; water, sodium, sodium-potassium mixtures, helium, air and carbon-dioxide as coolants; concrete, iron, boron, lead, earth and water as radiation or biological shields; and thorium and uranium-238 as breeder elements. Stainless steel and aluminum are employed as alloying and diluent materials in nuclear fuels. Zirconium and aluminum also serve as cladding materials for fuel elements and as alloying agents in control rods. Nuclear fuels suffer from physical disintegration and dimensional instability as a result of radiation and thermal cycling effects. Future developments in nuclear materials, which are considered to be essential before practical, low cost atomic power can be achieved, include 1) development of nuclear fuels which will operate at higher temperatures 2) reduction in cost of reactor materials such as zirconium, beryllium and heavy water 3) improvement in corrosion resistance of reactor components 4) increase in efficiency of moderating materials 5) development of more compact shielding materials and 6) reduction in cost of fuel recovery, processing and fabrication steps. These are all primarily metallurgical problems.
C. G. von Fredersdorff

2. APPLIANCES

Air Conditioning

Parmelee, G. V., Vance, P., and Cerny, A. N. ANALYSIS OF AN AIR-CONDITIONING THERMAL CIRCUIT BY AN ELECTRONIC DIFFERENTIAL ANALYZER. *Heatg., Pipg. and Air Condg.*, 28, 117-23 (1956) September.

The concept of the thermal circuit is a valuable tool in the analysis of thermal systems. The thermal system can be described by a set of differential equations easily derived from the thermal circuit. However, the actual solution of the equations has been found to be both laborious and tedious. This paper describes the results of the solution of the thermal-circuit equations as obtained by the use of an electronic differential analyzer. The independent variables, such as sol-air temperatures, were generated by electronic function generators; and the dependent variables, such as heat-flow rates and surface temperatures, were plotted with conventional recording equipment. An analysis of the load components due to a sun-exposed wall, a shaded window, and lighting in a typical office has been made. Authors' Abstract

Thom, Earl C. MEASURING THE NEED FOR AIR CONDITIONING. *Air Condg., Heatg. and Ventg.* 53, 65-70 (1956) August.

Increased attention to summertime discomfort is a basic reason for the rapid growth of air conditioning. The author has examined possible applications of a Discomfort Index as a means to establish the need for air conditioning. A number of maps are included which, by means of *iso*lines, graphically illustrate the data from a fairly large number of observation stations.
Author's Abstract

Burners

Carani, A. D. ADAPTER FOR STOVE BURNER GRILLS. U. S. 2,764,970 (1956) October 2.

Dean, R. C. (assigned to Industrial Systems, Inc.) FUEL BURNER. U. S. 2,767,784 (1956) October 23.

Cooking Heat Input

Jacobson, R. A. HEAT APPLICATION TO COMMERCIAL RANGE HEAVY-DUTY TOP SECTIONS. PART II: UNIFORM HEAT TOP RANGES. Amer. Gas Assoc. Research Report No. 1257 (1956) August.

An analysis was made by the American Gas Assoc. Laboratory of the merits of atmospheric and power burner applications to top sections of heavy-duty uniform heat top commercial ranges indicated that faster heating could be obtained by increasing the heat input rate of atmospheric burners. Substantial decreases in preheat time with an almost negligible decrease in thermal efficiency were obtained when normal heat input rate to the top section was increased by 100%. Further decreases in preheat time could be attained with still higher input rates, but decreased efficiency and associated problems encountered with the high temperatures made the use of higher heat input

rates unsatisfactory. As a guide for the manufacturer in rating his equipment, a method of determining the optimum design heat input rating is suggested and calculations are shown.

G. Kunst

Controls and Ignition

Dietz, G. E. and Hilgert, A. J. (assigned to Milwaukee Gas Specialty Co.) CONTROL APPARATUS FOR FLUID FUEL BURNING APPARATUS AND THE LIKE. U. S. 2,765,631 (1956) October 9.

Dinkelkamp, H. T. (assigned to Stewart-Warner Corp.) HYDRO-PNEUMATIC PRESSURE CONTROL APPARATUS. U. S. 2,765,804 (1956) October 9.

Dykzeul, T. J. and Schmidt, W. L. (assigned to Robertshaw-Fulton Controls Co.) CONTROL VALVE MECHANISM FOR FLUID FUEL BURNING APPLIANCES. U. S. 2,765,803 (1956) October 9.

Rowell, W. G. and Farmer, E. B. (assigned to Scully Signal Co.) SONIC CONTROL FOR BURNERS. U. S. 2,767,783 (1956) October 23.

Traver, C. H. (assigned to General Controls Co.) PILOT BURNER AND IGNITER THEREFOR. U. S. 2,768,677 (1956) October 30.

Wolff, J. A. (assigned to Milwaukee Gas Specialty Co.) THERMOELECTRIC SAFETY SHUT-OFF DEVICE. U. S. 2,765,029 (1956) October 2.

Pilot Problems

Dennis, J. H. HOUSEHEATING PILOT PROBLEMS. *Amer. Gas J.*, **183**, 18-20 (1956) September.

An Amer. Gas Assoc. Customer Service Committee Survey involving approximately 3-5 million units in the field revealed that pilots provide the most serious service problems. Year-around pilot operation is increasingly popular. The survey evaluation provides measures that must be instigated if pilot problems are to be minimized.

A. E. Richter

Radiant Space Heating

SCHWANK UNITS — MASTERTHERM UNITS. *Gas World* (British), **144**, 28-30 (1956) August 18.

Both units are designed primarily for commercial application. The reports made are confined to work carried out to assess the suitability of the units for industrial process applications requiring high temperature radiant heat.

A. M. Pelczarski

Refrigeration

De Lange, L. (assigned to Hartford National Bank and Trust Co.) COOLER CONSTRUCTION IN A HOT-GAS ENGINE. U. S. 2,764,879 (1956) October 2.

Space Heater

Davis, E. OIL BURNING FURNACE AND CONTROL. U. S. 2,766,818 (1956) October 16.

Valves

Bergquist, F. H. (assigned to Harper, P. S., Harper, C. L. and Harris Trust and Savings Bank) GAS VALVES. U. S. 2,765,810 (1956) October 9.

Lamar, C. C. (assigned to Harper, P. S., Harper, C. L. and Harris Trust and Savings Bank) GAS VALVES. U. S. 2,765,809 (1956) October 9.

Shuster, P. GAS RANGE BURNER VALVE HANDLE PROTECTOR. U. S. 2,764,968 (1956) October 2.

3. COMBUSTION AND INDUSTRIAL FURNACES

Combustion Charts

Kist, D. and Frumerman, R. SIMPLIFIED COMBUSTION CALCULATIONS. *Chem. Eng.*, **63**, 179-84 (1956) July.

Charts are presented enabling the calculation of flame temperatures and product compositions for methane and liquid hydrocarbon fuels.

S. A. Weil

Diffusion Flames

Smith, S. R. and Gordon, A. S. STUDIES OF DIFFUSION FLAMES. II. DIFFUSION FLAMES OF SOME SIMPLE ALCOHOLS. *J. Phys. Chem.*, **60**, 1059-62 (1956) August.

Alcohol diffusion flames were studied by means of sampling techniques for the analysis of the stable intermediates at several points within the flame. From the observed compositions, the authors propose mechanisms for the combustion in diffusion flames of methanol, ethanol, n-

propanol, and isopropyl alcohol. In these mechanisms, the initial steps are the pyrolysis of the alcohols. S. A. Weil

Flame Safeguards

Flanders, L. H., Poole, A. J., Lewis, H. P., Lind, G. E. WHAT YOU CAN EXPECT FROM TODAY'S FLAME-FAILURE SAFEGUARDS. *Power*, **100**, 90-3 (1956) September.

Answers to a questionnaire by *Power* on flame-failure safeguards are given by an insurance company, a boiler builder and 3 safeguard manufacturers. Combustion safeguards, principally the flame rod, photo-electric cell and lead-sulfide cell, detect the presence or absence of the boiler flame and may automatically shut off the fuel to the burner. Troubles leading to failure of flame have usually occurred with low-furnace temperatures (start-up or low loads), improper fuel-air ratios, leaks or faulty detector position. Modern safeguards, with air and fuel interlocks, trained operators, and periodical testing and maintenance are reliable in reducing explosion hazards. O. P. Brysch

Flue Gases

Crumley, P. H., and Fletcher, A. W. THE FORMATION OF SULPHUR TRIOXIDE IN FLUE GASES. *J. Inst. Fuel* (British) **29**, 322-7 (1956) August.

The factors controlling the oxidation of sulphur dioxide (SO_2) to sulphur trioxide (SO_3) in the combustion of fuels containing sulphur have been investigated in a small kerosene-fired furnace. The SO_3 contents of the flue gases from the furnace were determined chemically, and were shown to depend on the sulphur content of the kerosene, the flame temperature, the amount of excess air and the type of flame. The SO_3 content of the flue gases from a large oil-fired boiler has also been determined and compared with the results obtained in the small furnace. Authors' Abstract

Industrial Gas Turbine

Grindrod, J. GAS TURBINE AT WORK IN ITALY. *Gas Age*, **118**, 24-26 (1956) September 20.

A Ruston TA gas turbine that has been in operation for over 6500 hours on services loads is described. J. R. Hasenberg

SMALL GAS TURBINE IS NOW AVAILABLE. *Gas Age*, **118**, 43, 44, 63 (1956) September 6.

An English design to be manufactured in the United States by Clark Bros. broadens application of the gas turbine in industry. Unit can be adapted for use with natural gas, low-value furnace gases, liquid fuels or specified proportions of liquid and gaseous fuels. Light weight and compactness are other features.
Author's Abstract

Inert Atmospheres

Ipsen, H. N. AUTOMATIC RATIO CONTROL FOR ENDOTHERMIC GAS GENERATORS. *Metal Progress*, **70**, 107-9 (1956) August.

A new instrument for automatic control of air and gas ratio fed to endothermic gas generators assures accurate control of composition of the output gas. Author's Abstract

Metal Heating

Turner, C. A., Furczyk, A. A. and Lekberg, C. H. A STUDY OF THE EFFECT OF HEATING RATE BY GAS ON METAL FLOW CHARACTERISTICS OR PLASTICITY AND DIE WEAR. Amer. Gas Assoc. Interim Rept., Project IK-7 (1956) June.

Comparison is given of test results of drop hammer, hot twist and hot penetration working of metals which had been either "fast" or "slow" heated, along with detailed descriptions of equipment and procedures followed. Graphs and photomicrographs point up the differences observed. L. E. Potempa

Oil-Fired Boilers

BETTER BURNERS, BOILERS CAN BE MADE. *Nat. Petrol. News*, **48**, 125-126 (1956) August.

Esso Research and Engineering Co. has proposed these guides for improving boilers and burners to be employed with fuel oil: 1) lower firing rates; 2) more heat exchange space; 3) smaller but longer combustion chambers; 4) smaller end cones. A description of the individual tests and their results was made. Manufacturers approve Esso Research's ideas but object that costs would be high and public acceptance low. G. Kunst

Radiant Heat Meter

Cantle, G. S., El Din Aref, M. N., and Sakkal, M. F. THE MEASUREMENT BY MEANS OF A PROBE RADIOMETER OF RADIANT HEAT FLUX DISTRIBUTION AT CURVED SURFACES. *J. Inst. Fuel* (British), 29, 327-32 (1956) August.

The use of the probe radiometer described previously for the measurement of radiant heat flux distribution round tube surfaces may give rise to conditions which would render the direct application of the previous calibration invalid. If the tube is of small diameter, comparable with the size of the radiometer itself, then the sink disk of the radiometer may see surfaces other than that of the sink, and the temperatures of the surfaces thus seen are not a function of source and sink temperatures only, being dependent also upon tube spacing. Thus a new calibration curve is required for each tube diameter and spacing, but the present paper shows, with experimental illustrations, the order of minimum tube diameter to which the original calibration may be applied, and that for still smaller tube diameters the modified calibration curve can be determined quite readily from the existing characteristic of the instrument without further experimental calibration. Authors' Abstract

4. CARBONIZATION AND GASIFICATION

Benzol Recovery

CONTINUOUS BENZOLE RECOVERY AND RECTIFICATION. *Gas J.* (British), 287, 466, 67, 70 (1956) August.

A full-scale plant for continuously recovering and rectifying benzole has been designed jointly by Union Chimique Belge and Chemical Engineering Wiltons, Ltd and built by the former at a coke-oven plant near Brussels. A comparison of this plant with a conventional plant shows an annual saving of £14,350 per thousand tons of coal carbonized per day.

H. L. Feldkirchner

Carbonization

Jones, W. I. RECENT RESEARCH AND DEVELOPMENTS IN GREAT BRITAIN IN THE THERMAL TREATMENT OF COAL. Fifth World Power Conf. (Vienna) (1956) June 17-23: Paper 117 C/9; *Gas Times* (British) 88, 79 (abs) (1956) July 20; 237-9, 242 (1956) August 31; *Gas J.* (British) 287, 571, 574 (1956) Sept. 5.

This 5th World Power Conference paper deals with the production of solid smokeless fuels in Britain which will largely replace, in the next 10-15 years, the 19 million tons of domestic coal now contributing to air pollution. The raw materials will be largely the non-coking larger sizes, displaced from the domestic and locomotive coal market. Largest demand will be for fuel for open grates, which probably will be met by improved quality gas-works coke, although several experimental processes (Coalite, Grancole, Rexco) are in development. Fuels for closed appliances, chiefly briquetted chars also are under study. Research on fundamentals of production of metallurgical coke (fluidity, blending, heating rate, bulk density) now under way will undoubtedly contribute to the solution of the problem. O. P. Brysch

Lee, G. W. and Graham, J. P. TRENDS IN CARBONISATION PRACTICE AND RESEARCH IN GREAT BRITAIN. *Gas World* (British), 144, (Cokg. Sect.), 31-6, 38 (1956) August 4.

In the coking industry, the predominating influence is still exerted by the iron and steel industry requirements for blast furnace coke. This survey, presented at the 5th World Power Conference (Vienna) bears out the conclusions of 5 years ago voiced at the 4th Power Conference. The coking industry is faced with maintaining and improving the quality of metallurgical coke from a diminishing supply of good quality coking coals. Problems thus include chiefly the preparation of coal charges from existing reserves and ranges of coals, and the discovery of mechanisms of coke formation so that the properties of coal needed for optimum coke quality can be established. Laboratory and industrial scale research programs are reviewed. A full-scale pilot oven is under construction at a new plant. A bibliography of 28 recent items is given. O. P. Brysch

Coal Extraction

Kroeger, C. DIE STEINKOHLEEXTRAKTION—III DIE CHEMISCHE UND PHYSIKALISCHE NATUR DER EXTRAKTE: EXTRAKTION UND VERKOKUNGSVERHALTEN DER KOHLEN. (COAL EXTRACTION —THE CHEMICAL AND PHYSICAL NA-

TURE OF THE EXTRACTS: EXTRACTION AND COKING BEHAVIOR OF THE COALS). *Erdoel und Kohl* (German), 9, 620-24 (1956) September.

From the previously published articles it is obvious that the coal extracts vary with the solvent, the temperature, and the degree of coking. The chemical and physical nature of these extracts was determined in detail. The isolation of definite compounds, the separation with selective solvents and the chromatographic separation of extraction fractions was investigated. The coking behavior of the coal and the extracts have been studied and results are described in general. G. Kunst

Coal Grinding

Brown, R. L. and Hurley, T. F. SOME EXPERIENCES OF PULVERISING COAL. Fifth World Power Conference, Vienna, Paper 116 c/8 (1956) June 17-23.

Using a standardized procedure, the grindability indices of nearly 150 British coals of varying rank were determined in a laboratory study using a Hardgrove grindability machine. Grindability was found the be closely associated with rank and when plotted against volatile matter produced a parabolic curve. The strongly caking coals tended to be softer than the non-caking coals. The laboratory studies were followed by three series of tests in a commercial Babcock and Wilcox Type E mill with a rated output of 7 tons per hour in which the influence of such variables as size of fuel fed, moisture content and type of coal on the grindability was investigated. Results showed that the power consumed in the mill was a function of the weight of the fines of minus 200-mesh sieve produced per hour. The performance coefficient of the mill (ton fines/kwh) is shown to be a function of the Hardgrove index of the coal indicating that the Hardgrove index is a criteria for evaluating coal pulverization in a Type E mill.

E. J. Pyrcioch

Strasser, D. M. (assigned to The Texas Company) PROCESS FOR PULVERIZING SOLIDS IN FLUID SUSPENSION. U. S. 2,763,434 (1956) September 18.

A slurry consisting of granular solids, such as coal, and water is pumped at a pressure of 3500 psi into a turbulent heater where it is heated to 800° F. The pressure of the preheated slurry is reduced suddenly to 1000 psi which results in vaporization of the liquid and the complete suspension of the solids in the steam. This suspension is passed through an additional section of tubing where the highly turbulent flow of the steam through the tube causes innumerable collisions of the solids particles with each other and with the walls of the tubing resulting in a high degree of pulverization. Pulverization to a size of 1 to 5 microns is claimed.

E. J. Pyrcioch

THE PETROGRAPHIC PREPARATION OF COALS FOR COKING. *Coke and Gas* (British), 18, 246-51, 256 July; 288-92 (1956) August.

This article describes in detail Burstlein's process of separating the petrographic constituents of a coal by crushing the mine-head coal by means of a breaker instead of a regular hammermill. Since the petrographic constituents vary greatly in their size and hardness, by the application of Burstlein's method of grinding, the different petrographic constituents appear in different mesh sizes. By blending these separated powdered petrographic constituents in a definite proportion and carbonizing the resulting mixture a coke is produced with a uniform and homogeneous structure, while carbonizing a blend produced by the regular hammermill will result in a coke with uneven texture. Variations in the crushing, separating and reblending are described as applied on an industrial scale in the gas ovens at Oran and Algiers, and in metallurgical coke ovens at Gelsenkirchen, Longwy, Thionville and Pont-à-Moussan. K. C. Channabasappa

Coal Structure

Bond, R. L. BESCHREIBUNG DES FEINBAUES DER KOHLEN AUF GRUND IHRER EIGENSCHAFTEN ALS MOLEKULARE SIEBE. (DESCRIPTION OF THE FINE STRUCTURE OF COAL ON THE BASIS OF THEIR PROPERTIES AS MOLECULAR SIEVES). *Brennstoff Chemie* (German) 37, 233-4 (1956) August 15.

The heat of moistening per unit surface for absorbent materials rich in carbon normally varies only little with the composition of moistening liquid. For bituminous coal it decreases however with increasing molecular volume of the wetting liquid. Therefore there are con-

strictions in the structure which inhibit the admittance of bigger molecules. Similar phenomena are observed on adsorption and on measurements of porosity on coal. The experimental results indicate a porous system of 10-20 Angstrom and a second one with 15-30 Angstrom diam. One can conclude from the adsorption isotherms that one does not deal with cylindrical pores but flat capillaries. The porous system exists to 600°. At higher temperatures the accessibility decreases but the inner surface exists to 900° C. G. Kunst

Gasification

Dent, F. J. DEVELOPMENTS IN THE GASIFICATION OF SOLID FUELS IN GREAT BRITAIN. *Gas J.* (British), 287, 633-34, 236 (1956) September 12; *Gas Times* (British) 88, 280, 285-7, 290, (1956) Sept. 14.

The recent developments in the production of gas from coal have included improvements in the operation of water gas plants and experimental work at pilot plant scale in complete gasification of coal and in coal hydrogenation. Blast pressures in water gas generators have been increased up to 60 in w.g., resulting in more than a 50% increase in the output per sq. ft. Tests were made on the recovery of waste heat in blow gases by utilizing the hot gases to preheat the air and steam to the generator, leading to an increase in production of 14 percent. A new atmospheric process for complete gasification of coal has been developed in which water gas is produced by steaming a fluidized bed of fine coal which is circulated through a second vessel where its temperature is raised by partial combustion with air. Experimental work on the hydrogenation of coal at pressures up to 50 atmospheres and temperatures up to 1650° F. was continued at pilot plant scale with the production of a gas of 500 Btu. per SCF. E. J. Pyrcioch

Gilsonite Operations

HYDRAULICALLY MINED GILSONITE HAULED VIA PIPELINE. *Mining Eng.*, 8, 785, 788, 790 (1956) August.

Geology, mining operations, transport by pipeline and processing of gilsonite by the American Gilsonite Co. are briefly described. Low sulfur veins of gilsonite in the Uintah Basin (E. Utah and W. Colo.) are mined by hydraulic jets in drifts radiating from a main shaft. Below ¾ inch ore is pumped as slurry to the surface, cleaned and stored in 5000-bbl agitated tanks which feed the 71-mile, 6-inch diam. pipeline to Gilsonite, Colo. Here the ore suspension is agglomerated with oil, separated and passed to a delayed coker, fractionator and reformer. Low-ash coke will be produced at 250-550 tons/day (50% yield) and gasoline (35%) and 1400 Btu gas (15%) are also produced.

O. P. Brysch

NEW RAW MATERIAL FOR COKE AND GASOLINE. *Petrol. Refiner*, 35, 153-55 (1956) August.

A description is given of the plant being built by the American Gilsonite Company in Colorado to process gilsonite. A flow-sheet and flow description citing process variables is included.

H. L. Feldkirchner

Hydrogasification

Pettyjohn, E. S. and Linden, H. R. (assigned to The Institute of Gas Technology, Chicago, Ill.) METHOD OF MAKING A FUEL GAS. U. S. 2,759,806 (1956) August 21.

This patent covers the process of pressure hydro-gasification as applied to the production of a fuel gas from natural gas liquids. The process consists of thermal cracking of vaporized natural gas liquids in a tube furnace in the presence of a hydrogen-rich gas. This process will produce a fuel gas which is interchangeable with natural gas. W. G. Bair

Hydrogen Production

Berg, C. H. O. (assigned to Union Oil Co. of California) HYDROGEN PRODUCTION PROCESS AND APPARATUS. U. S. 2,759,799 (1956) August 21.

This invention provides a process in which a carbonaceous or hydrocarbonaceous material is reacted with steam to produce a raw hydrogen-containing gas mixture, the gas mixture is subjected to a first adsorption step leaving a hydrogen stream contaminated with carbon monoxide and oxygen, these contaminants are hydrogenated with part of the hydrogen in the gas stream to be purified, and then a second adsorption step in the same adsorption column adsorptively separates the hydrogenated products from a substantially pure hydrogen stream.

Selected Extracts

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Compression

Bates, G. O., English, J. E. and Franklin, G. M. EBULLITION COOLING OF GAS ENGINES. *Amer. Soc. Mech. Eng. Trans.*, 78, 1065-69 (1956) July.
Experience with ebullition-cooled gas engines over a 10-month operating period is reported. Satisfactory operation was found, and it is predicted that ebullition cooling will eventually supersede conventional water cooling.
R. F. Bukacek

Carameros, A. H. EL PASO'S REPAIRMEN KEEP TURBINES ON LINE. *Pipe Line Ind.*, 5, 34-39 (1956) September.
Engineers and maintenance men at El Paso Natural Gas Company's ten gas-turbine compressor stations met special conditions with equipment modifications. Now, with shakedown behind them, they look forward to high performance and low cost operations.
Author's Abstract

Farnsworth, H. and Stumm, J. COMPRESSOR STATION INCORPORATES NEW DESIGN FEATURES. *Petrol. Eng.*, 28, D33-35 (1956) August.
A description of San Diego Gas and Electric Co's. new compressor station near Moreno, California.
R. F. Bukacek

Condensate Recovery

Chadwick, J. L. and Crow, J. H. 6,000 GAL. MORE STABILIZED CONDENSATE PER DAY. *Oil Gas J.*, 54, 102, 104 (1956) August 6.
This article reports the use of propane refrigeration to augment an existing low temperature separator. The separator was becoming less effective as gas pressures declined.
R. F. Bukacek

Dehydration

Daugherty, R. A. A NEW WAY TO DEHYDRATE GAS. *Petroleum Eng.*, 28, E13-14, 16 (1956) September.
One of the pesky problems that crops up in all three branches of the petroleum industry is dehydration of natural gas. Wherever natural gas is handled—at the wellhead, in the pipe line, or in the processing plant, its water vapor causes difficulties. Removing it is a non-profit operation and more often than not an expensive one. This new method, which has more than tripled the efficiency of calcium chloride as a desiccant, may be the best solution yet.
Author's Abstract

Drilling

Brooks, W. B., Randerson, L. W. and Schall, F. W. NEW DRILLING DEVELOPMENTS. Proc. Fourth World Petroleum Cong., Sec. II, 91-105 (II/C, Paper 1) Rome, (1955) June.
Since the first oil well was drilled, hundreds of drilling devices and techniques have been either field-tested or at least suggested as being worthy of consideration and experimentation. This paper is a review of several of the new drilling techniques and improvements in conventional methods. An indication of the potential applicability and the limitations of each method is included in the discussion. Some of the methods discussed are impractical for ordinary oil-well drilling but might find application with improved technology and metallurgy. Some of the methods discussed have already proved their economic worth.
Authors' Abstract

Trebin, F. A. TURBINE DRILLING IN THE USSR. Proc. Fourth World Petroleum Cong., Sec. II, 613-22 (II/T.O.P. Paper 7), Rome, (1955) June.
Development of improved turbo-drills in Russia is outlined from 1925 to date, and the difficulties, advances, and results in various types of rock and in various drilling techniques are discussed and diagrammed. From 1940 when first applied, multistage turbo-drilling had increased to 65 percent of all drilling in 1954. The modern 10-inch turbo-drill, using water as drilling fluid, operates at 790 rpm with 450 HP effective face capacity at 74 atm pressure. Research on drilling-bits, slant-hole techniques and core recovery are under way.
O. P. Brysch

DRILLING AND PRODUCTION EQUIPMENT DEVELOPMENT SETS FAST INDUSTRY PACE. *Petroleum Eng.*, 28, B37-39 (Reference Equipmt Issue) (1956) July 15.
Improvements over the past few years in drilling equipment and techniques have resulted in

increased drilling activity at about the same cost per foot. Increased penetration rates, more flexible power supplies, and changes in rig layouts to facilitate setup and operation, coupled with improved drilling equipment, have resulted in improved and cheaper operations. New oil-well cements and completion procedures have been developed. Equipment has been provided for safely handling pressures of 10,000 to 15,000 psi at the well-head. Fracturing has been a big boon to the producer, and the introduction of automatic-remote control lease operation has reduced time and man-power requirements.

B. E. Eakin

Gas Flow

Navidi, M. A NEW CHART FOR USE IN GAS-FLOW CALCULATIONS. *Oil Gas J.*, 54, 157-60 (1956) September.

A chart from which quick approximations of pipeline flows can be made is presented. It is unclear what friction factor is incorporated in the chart.

R. F. Bukacek

Flow in Pores

Griffith, J. D. and Nielsen, R. F. SOME STUDIES ON MISCIBLE FLUID DISPLACEMENT. *Producers Monthly*, 20, 41-44 (1956) Sept.

Laboratory studies were made on the displacement of a liquid in a porous medium by another liquid miscible with it. The authors consider the effects on the displacement process due to variations in the fluid viscosities and flow rates. The experiments were made on a sandstone core with the liquids being *Soltrol* and *Pentane*. Experimental results were found in fair agreement with values predicted by theoretical considerations for both high and low viscosity ratios. The effect of velocity is found to be small.

P. Wellek

Gas Fractionation

Natta, G. (assigned to Montecatini, Soc. gen. per l'Industria Mineraria e Chimica) CONTINUOUS PROCESS FOR SEPARATING TWO GASES HAVING BOILING TEMPERATURES WHICH CLOSELY APPROACH ONE ANOTHER. U. S. 2,757,754 (1956) August 7.

This invention relates to a method of separating two gases having boiling temperatures which closely approach each other. It is known that the separation of such gases can be facilitated by employing fractional absorption processes or extractive distillation, in conjunction with a selective solvent. This method was found to be too expensive, but a relatively inexpensive continuous separation with almost complete recovery of the components at high concentration may be obtained by stripping the solvent solution after degassing with the less soluble component of the two. Furthermore the process according to the present invention permits operation at economically low pressures, with low gas concentrations in the solvent solution under conditions at which the selectivity of the solvent is highest.

G. Kunst

Geophysical Exploration

Agnich, F. J. EXPLORATION FOR REEFS BY GEOPHYSICAL METHODS. Proc. Fourth World Petroleum Cong., Sec. I, 619-634 (I/E, Paper 4) Rome, (1955) June.

Methods used in geophysical exploration for limestone reefs are described. Limestone reefs are defined and their structural charactristics given. Close coordination of all geological and geophysical data is extremely important throughout an exploration program. Where reefs are shallow and the density contrast with surrounding materials is relatively great, the gravity meter can be successfully employed. The seismic refraction method, like the gravity method, is strictly limited to shallow reefs. Even then a favorable contrast in velocity must exist between the reef and the geologic section around and above it. The most effective geophysical method in reef location has been the reflection seismograph. Data must be interpreted in the light of effects caused by reefs. Compactional folding above a reef is a prime criterion for identification by reflections. Other seismic evidences of reefs are described and a successful program specifically designed to locate a reef is discussed briefly.

Author's Abstract

Cortes, H. C. and Gsell, R. N. GEOPHYSICAL PROSPECTING OVER CONTINENTAL SHELVES. Proc. Fourth World Petroleum Cong., Sec. I, 575-603 (I/E, Paper 2) Rome, (1955) June.

Geophysical methods were initiated and successfully used on land, and later in marshes and inland waters. After prolific oil fields were found in California, Louisiana, and Texas near

ocean waters, it became a question of time as to when open water prospecting would be done. Many difficult problems were encountered and solved in extending the search off-shore. New and different equipment became a necessity. The principal methods used, in order of increasing resolution and operating costs, have been magnetic, gravimetric, and seismic. Major amounts of offshore geophysics have been done off California, Louisiana, and Texas. Comparatively small areas have been covered off-shore with the airborne magnetometer. The remote-controlled gravity meter, or gravimeter, has been employed in a number of areas. The reflection seismograph is the most widely used method. Early surveying was done by wire line and transit. These have been replaced by radar, continuous radio wave and sonar methods. Since the greatest volume of marine geophysical work has been conducted in the Gulf of Mexico off Louisiana and Texas, the largest number of offshore oil and gas discoveries has been in these areas. To July, 1954, there have been 37 discoveries off the coast of Louisiana and two off the coast of Texas. Seismic work on large open water areas can be done as cheaply, or more cheaply, per linear mile than on land. The economic climate created and maintained by governments will be a major factor in the future geophysical prospecting and development of the continental shelves.

Authors' Abstract

Hammer, S. I. MODERN METHODS OF GRAVITY AND MAGNETIC INTERPRETATION. Proc. Fourth World Petroleum Cong., Sec. I, 635-646 (I/E, Paper 5) Rome, (1955) June.

Recent developments in gravity and magnetic interpretation techniques in exploration for petroleum reveal a definite trend towards more quantitative evaluation and utilization of data. This is a logical consequence of (1) improved instrumentations which yield higher-quality surveys and (2) the need for reconnaissance surveys to guide and localize more costly phases of exploration such as seismic work, leasing, and test drilling. Modern interpretation techniques in use and underdevelopment are reviewed and illustrated by selected maps and figures. These include "residual" and "second derivative" maps, "resolution", "continuation" "statistics", and "electronic computations". Underground observations to yield a third dimension in exploration are included. Important work on geophysical rock properties is considered. Economics in the over-all exploratory effort which may result from intelligent use of gravity and magnetic surveys are mentioned.

Author's Abstract

Migaux, L. and Kunetz, G. APPORTS DES METHODES ELECTRIQUES DE SURFACE A LA PROSPECTION PETROLIERE. (APPLICATION OF SURFACE ELECTRIC METHODS TO PETROLEUM PROSPECTING. Proc. Fourth World Petroleum Cong., Sec. I, 545-574 (I/E Paper 1) Rome, (1955) June.

This paper aims at making more widely known the frequently ignored possibilities of applying electric methods to oil prospecting. After briefly recalling the peculiar characteristics which distinguish these methods from the traditional ones such as gravimetric and seismic, the paper furnishes a series of practical examples taken from prospecting carried out under varying conditions, and compared with the results of borings and other methods. It is shown that electric methods may be considered a fully efficient instrument which has already been of outstanding service in oil prospecting and deserves to be adopted on a far wider scale.

Authors' Abstract

Salvatori, H. NEW DEVELOPMENTS IN SEISMIC METHODS. Proc. Fourth World Petroleum Cong., Sec. I, 605-618 (I/E, Paper 3) Rome, (1955) June.

The past few years have seen extensions and refinements of older seismograph techniques. Although no fundamental change have taken place, methods and devices have been improved and expanded to enlarge the sphere of activity of the reflection method. Pattern shooting as an accepted field technique has made possible the exploration of previously unworkable areas. Individual trace analysis has proven valuable for special problems. Seismic amplifiers now provide automatic volume controls with several rates of response that may be readily adjusted to meet the particular requirements of specific areas. Replayable recording on magnetic tape offers a new degree of versatility in instrumentation. Field equipment has seen several im-

portant improvements and new devices. Among these are the air and auger drills, specialized tracked vehicles and a cable handling device. Continuous control of velocities and moveouts of individual reflections removes an important source of interpretation errors. Research and development is proceeding apace from investigation of basic earth physics and information theory to new and improved instruments and techniques. Author's Abstract

Skeels, D. C. CORRELATION OF GEOLOGICAL AND GEOPHYSICAL DATA. Proc. Fourth Petroleum Cong., Sec. I, 665-673 (I/F, Paper 2) Rome, (1955) June.

The importance is stressed of careful coordination of geological and geophysical data in both regional and local exploration. The application of geological information in guiding geophysical interpretations, and the use of seismic records in subsurface mapping of stratigraphic units is discussed and is illustrated by examples from several areas. Author's Abstract

H_2S Removal

Brown, K. M. (assigned to Universal Oil Products Co.) MEANS FOR REMOVING AN ACIDIC COMPONENT, PARTICULARLY HYDROGEN SULFIDE, AND WATER FROM FLUID STREAMS. U. S. 2,761,755 (1956) September 4.

This invention is directed to an improved combination type of multiple stage operation utilizing an alkali metal hydroxide, such as caustic soda, for removing undesired acidic components such as H_2S and CO_2 from a fluid stream, and for simultaneously drying the stream. Drying is performed in a second absorption zone which is fed with solid caustic or with a concentrated solution thereof. Removal of acidic components is effected in a first zone using a more dilute solution prepared from the caustic effluent from the second stage. D. M. Mason

LP-Gas, 1955

LPG SALES DURING 1955 SHOW LARGEST INCREASE IN INDUSTRY'S HISTORY. *Butane-Propane*, 18, 31-34 (1956) October.

During 1955 the LP-gas industry reported to the Bureau of Mines an increase of 884,350,000 gallons or 17% above 1954, to reach a total of 6,174,191,000 gallons. Tabulations are given by zone, state and consuming market. All markets showed increased sales—the largest, domestic and commercial fuel, gaining seven percent. Liquefied refinery (LR) gases are now itemized under "industrial," and iso-butane, ethane and methane-ethane mixtures are reported under "chemical" uses. O. P. Brysch

Network Analysis

Wilson, G. G. and Kniebes, D. V. DISTRIBUTION SYSTEM ANALYSIS WITH THE ELECTRONIC DIGITAL COMPUTER. *Gas*, 32, 37-44 (1956) August.

A method of solving gas distribution system network flow problems by use of a digital computer is described. This method involves the use of a general computer program based on a modified Hardy Cross calculation procedure which was developed at the Institute of Gas Technology. The steps involved in the solution of network flow problems by use of this program are illustrated by use of a 28-loop sample problem and a breakdown of the time required to carry out each of these steps for this sample is presented. The convergence characteristics of the modified Hardy Cross procedure are also discussed. G. G. Wilson

Organic Sulfur Removal

Gains, W. C. (assigned to Chemical Construction Corp.) REMOVAL OF ORANIC SULFUR COMPOUNDS FROM GASES. U. S. 2,762,452 (1956) September 11.

Sulfur compounds such as mercaptans, alkyl sulfides, alkyl disulfides, thiophenes, and the like may be removed from dried fuel gases by adsorption on silica gel at normal or room temperature. The gel is reactivated by heating to about 300°C to 700°C, preferably in a current of hot dry air or hydrocarbon combustion products. D. M. Mason

Pipe-Driving

Roehm, C. L. HOW PIPE DRIVING SAVES TIME, MONEY. *Gas Age*, 118, 15-17, 53 (1956) August 9.

A brief summary of the development of pipe-driving equipment and the advantages of driving pipe are followed by an illustrated description of the equipment and technique used by the Delaware Power and Light Co. to drive service and small main piping. The equipment used includes connecting pins, driving point guides and an air hammer. G. G. Wilson

Radio-Tracer Exploration

Gore, G. L. RADIOACTIVE TRACER TECHNIQUES. *J. Petrol. Techn.*, 8, 12-17 (1956) September.

This paper summarizes the principal applications of radioactive tracer materials in the oil field, and describes the different tools and techniques used in conducting various sub-surface surveys. These include: location of thief zones during drilling, determination of top of cement following cementing operations, evaluation of the success of remedial squeeze cement jobs, control and evaluation of acidizing operations, performance of relative permeability surveys, detection of tubing or casing leaks, and identification of produced brine following "breakthrough" in secondary recovery projects.

B. E. Eakin

Reserves

Davis, R. E. and Wege, J. M. VALUATION OF GAS RESERVES. *J. Petrol. Techn.*, 8, 18-21 (1956) September.

Two examples are given of a method of evaluation of gas reserves. The problem of estimating the value of stored gas is also discussed.

B. E. Eakin

Reservoir Engineering

Van Wijk, W. R., De Vries, D. A., and Thijssen, H. A. STUDY ON P. V. T. RELATIONS OF RESERVOIR FLUIDS. Proc. Fourth World Petroleum Cong., Sec. II, 312-324 (II/E, Paper 2) Rome, (1955) June.

It is suggested that standard laboratory tests are carried out to determine P. V. T. data of reservoir fluids instead of trying to imitate actual behavior in a reservoir during production. The standard test should enable calculation of P. V. T. data, especially the total volume of gas and liquid for various production practices. The fraction of gas flashed off a reservoir fluid when the pressure is decreased is calculated. No equilibrium constants are used at high pressures. Fluid volume and gas volume are calculated with the aid of existing correlation methods, and if the bubble point pressure is known, the Y factor of the reservoir fluid can be calculated with a degree of inaccuracy of approximately 10%. If a differential vaporization test is carried out in the laboratory, flash vaporization can be calculated from it with a degree of inaccuracy which is estimated at approximately 2%, and, conversely, differential vaporization can be calculated from a flash test to the same degree of accuracy.

Authors' Abstract

Salt Dome Reserves

Halbouty, M. T. and Hardin, G. C., Jr. NEW GEOLOGICAL STUDIES RESULT IN DISCOVERIES OF LARGE GAS AND OIL RESERVES FROM SALT DOME STRUCTURES IN THE TEXAS-LOUISIANA GULF COAST. Proc. Fourth World Petroleum Cong., Sec. I, 83-101 (I/A/1, Paper 4) Rome, (1955) June.

Although beds of Tertiary age in the Gulf Coast of Texas and Louisiana constitute one of the most prolific oil producing provinces in the world, there is an absence of large tectonic movements and little regional folding, and therefore the area does not have major structural features of great relief which characterize many other oil producing provinces in the world. The Gulf Coast was, and still is, an area of low relief, both inside and beyond the coast line, with deposits through the Tertiary made up principally of continental beds and of sediments deposited in shallow marine waters, with a series of regressions and transgressions, with the net effect of moving the shore line toward the south. During these oscillations there occurred erosional periods and consequent minor, but effective, truncation of beds and traps for accumulation of oil and gas. Despite the absence of structures of great relief, accumulations of hydrocarbons are present in the Gulf Coast in less intense features, such as small anticlines, faults, faulted anticlines, sand lenses, stratigraphic traps of all types, reefs, and a combination of these structural and stratigraphic forms. The general progressive and thick deposition during the Tertiary in this large Gulf Coast homocline, amounting to a total of 50,000 feet, has resulted in certain structural features, among which the most outstanding are the piercement-type salt domes. The motive force of the uplift of these domes has been the static weight of the thick Tertiary sediments, so that the great vertical growth of the domes has taken place during the Tertiary. Because of the uplift of the domes through thousands of feet of strata, the conditions for oil accumulation around them is excellent. It was the dis-

covery of production from the caprock of a piercement-type salt dome that initiated the oil industry in the Gulf Coast area. New thinking in subsurface geological studies of these salt domes has resulted in the discovery of many millions of barrels of oil and trillions of cubic feet of gas. These studies have become most important, and this paper reveals the approach of such studies and the results that can be obtained by exploring behind them.

Authors' Abstract

Thermal Drive

Van Heiningen, J. and Schwarz, N. RECOVERY INCREASE BY "THERMAL DRIVE". Proc. Fourth World Petroleum Cong., Sec. VII, 299-312 (II/E, Paper 1) Rome, (1955) June.

The possibilities of "Thermal Drive", i.e. the heating of an oil reservoir in order to decrease the viscosity of the crude and consequently increase recovery, are discussed. An attempt is made to answer questions such as: "What are the present aspects of increasing recovery by thermal drive?"; "How do the different production characteristics of reservoirs enter into the picture?;" "What heating methods are best suited for the purpose?;" "Can the method be applied in an economic way?" By comparing the increase in recovery obtained by a given, uniform rise in temperature of solution-gas drive reservoirs with that obtained by the same rise in temperature of water drive reservoirs, it is shown that solution-gas drive fields offer no prospects for heating methods; water drive fields on the other hand offer prospects, provided the oil/water viscosity ratio is high enough. A survey is given of possible heating methods. One example is worked out in some detail. From the results it follows that hot water flooding may economically increase the recovery by 50-70% or more, if a cheap source of energy, in certain areas for instance natural gas, is available. Authors' Abstract

Two-Phase Flow

Baxendell, P. B. PIPELINE FLOW OF OIL AND GAS MIXTURES. Proc. Fourth World Petroleum Cong., Sec. II, 342-351 (II/E, Paper 4), Rome, (1955) June.

The purpose of this paper is to define a procedure simplifying use of the theoretical energy equation for predicting pressure losses in two-phase pipeline flow. An empirically derived relationship linking density, velocity and pipe size with friction factor is presented, which is analogous with the Reynolds Number relationship for single-phase flow. This relationship is believed to hold good under turbulent flow conditions regardless of crude characteristics. With decreasing mass velocity and consequent transition from turbulent to slug or stratified forms of flow, the relationship changes form and while a definite trend still exists in the case of the La Paz conditions investigated, it is considered that this trend will vary somewhat with crude viscosity. Further investigation of this point is in progress. Details are given of the method of constructing the working graphs from standard PVT analysis. The accuracy of the method is apparently ± 5% for operation in the turbulent zone. Though not definitely universally applicable for non-turbulent flow, it provides solutions accurate within ± 10% under these conditions for La Paz.

Author's Abstract

Underwater Lines

Judah, M. A. LONGEST UNDERWATER PIPE LINE NEARS COMPLETION. *Pipe Line Ind.*, 5, 10-15 (1956) July.

A brief, profusely illustrated description of the construction techniques and materials used in marshy right-of-way, and a Mississippi river crossing of TGT's "Muskrat Line".

G. G. Wilson

Underground Storage

Ball, D. WHAT ARE THE REASONS FOR UNDERGROUND GAS STORAGE? *Gas*, 32, 95-100 (1956) August.

An analysis is presented of the effect of underground storage on the operation of various phases of the gas industry. Included are: storage as it affects the producer, pipeline, utility, and consumer; types of storage, including reservoirs and caverns, and operation and organization of underground storage facilities.

B. E. Eakin

Well Practise

Solliday, A. L. MODERN WELL COMPLETION METHODS IN U. S. A. Proc. Fourth World Petroleum Cong., Sec. II, 59-73 (II/B, Paper 1) Rome, (1955) June.

This paper presents a review of modern well

completion methods in the U. S. A., with special emphasis placed on the most recent developments. These include: 1. recognition and determination of the permeability impairment often incurred during drilling-in and perforating operations and partial elimination of this damage by the use of special drilling fluids; 2. development of methods and tools to eliminate need of a drilling rig during completion operations; 3. improved acidizing and chemical treating techniques through the use of additives and surfactants; and 4. refinement and new applications of hydraulic fracturing which include large-volume fracturing, fracture placement, improved propping agents, and special fracturing fluids. The importance of these developments to the oil industry is discussed. Criteria are offered which aid in selecting the best methods for various reservoir conditions encountered. Author's Abstract

Walstrom, J. E. SYMPOSIUM ON WELL BORE SURVEYS. Proc. Fourth World Petroleum Cong., Sec. II, 155-273 (II/D, Paper 1) Rome, (1955) June.

When a hole has been drilled, or at intervals during the drilling, it is a general practice to run an electrical survey or a radioactivity survey to secure a complete record of the formations penetrated. Such recordings are if immediate value for the geological correlation of the strata, and also for the detection and evaluation of possibly productive horizons. In the present state of the electric logging technique, several different kinds of resistivity curves or logs can be recorded in bore holes in addition to the potential, or "SP", curve. The various types of resistivity logs correspond to the use of different resistivity measuring devices, and are accordingly designated as conventional logs, —*Laterolog, Guard Electrode Log, Induction Log, Microlog, Micro-Laterolog,* and *Contact Log.* Radioactivity logging includes the gamma and neutron logs which, respectively, record the natural radioactivity of the formations and the effects due to bombardment of the formations by neutrons. Furthermore, the information obtained from electrical or radioactivity logs may be supplemented by side wall cores of the formations taken from the walls of the hole, or by other types of investigations which can be performed in drill holes, such as caliper surveys, directional surveys, dipmeter surveys, temperature surveys, and several others. Many of the logging and evaluation methods, including logs and surveys made in producing wells, are separately described in the articles comprising this symposium on well bore surveys. Author's Abstract

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Fracturing

Hubbert, M. K. and Willis, D. G. IMPORTANT FRACTURED RESERVOIRS IN THE UNITED STATES. Proc. Fourth World Petroleum Cong., Sec. I, 57-81 (I/A/1, Paper 3), Rome, (1955) June.

The cumulative oil production of the United States up to the end of 1952 was 45.5 billion (45.5×10^9) barrels. Of this, an excess of 0.7 billion barrels or 1.5 percent was obtained from fractured reservoirs; and the ultimate production from these reservoirs will probably exceed 2.5 billion barrels. The most important fractured reservoirs in the United States are: the Miocene Monterey shale and chert from which the fields in the Santa Maria Valley in California produce; Jurassic basement schists from which the Edison, Wilmington, and several other California fields produce in part; the Wasatch and Green River shales in the Uinta Basin of Utah from which the Roosevelt and Duchesne fields produce; the Upper Cretaceous Pierre shale which is the reservoir rock for the Florence and Canon City fields in the Denver Basin; the Mississippian and Ordovician limestones and dolomites from which most of the Williston Basis; fields produce; the Permian Spraberry sillstones from which oil is produced over a large area in the Midland Basin of west Texas; the Ordovician Ellenburger limestone and dolomite from which prolific production is obtained in west and north-central Texas; the Upper Cretaceous chalks which are productive in southeast-central Texas, northwest Louisiana and western Alabama; a group of serpentine masses derived from buried Upper Cretaceous volcanoes in southeast-central Texas; and the Devonian Ohio bituminous shale from which large quantities of gas are produced in the Big Sandy and associated fields in eastern Kentucky and neighboring areas. Authors' Abstract

Hydrocarbon Cracking

Berger, C. V. and Appel, H. R. DECOMPOSITION OF HYDROCARBONS. *Ind. Eng. Chem.*, 48, 1566-75 (1956) September Part II.

The latest articles and patents concerned with the decomposition of hydrocarbons which are of interest to the petroleum industry are reviewed. The review is broken up into three sections, Thermal Decomposition, Catalytic Cracking and Reforming, and these in turn are divided into Theoretical and Industrial.

H. A. Dirksen

Hydroforming

Haensel, V. (assigned to Universal Oil Products Company) CATALYTIC REFORMING OF HIGH NITROGEN AND SULFUR CONTENT GASOLINE FRACTIONS. U. S. 2,758,064 (1956) August 7.

The object of the invention is to provide a process for effecting the catalytic reforming of high nitrogen- and sulfur-content gasoline fraction in a manner which precludes the contamination and deactivation of the catalyst comprising platinum, alumina and combined halogen. This is accomplished by utilizing a prehydrogenation and hydrocracking step, followed by separation and fractionation, in combination with and prior to the catalytic reforming of the gasoline fraction. H. A. Dirksen

Oil Strata Research

Bienner, F., Bonnard, E., Burger, J. J., Gayral, R., Levy, R., Louis, M., Metrot, R., Salle, C. and Pechelbronn, STE. CONTRIBUTION DE LA GEOCHIMIE A L'ETUDE DE LEVOLUTION DES HUILES BRUTES DANS LES BASSINS SEDIMENTAIRES. (GEOCHEMISTRY IN THE STUDIES OF EVOLUTION OF CRUDE OILS IN SEDIMENTARY BASINS.) Proc. Fourth World Petroleum Cong., Sec. I, 337-353 (I/C Paper 1) Rome (1955) June.

Some crude oils exposed to air and sunlight, evolve gradually toward the formation of asphalts. Particular hydrocarbons are transformed into resins; they subsequently yield asphaltenes and carbenes. This evolution is accompanied by a change in its chemical nature; thus a paraffinic or mixed oil produces a naphthenic asphalt. Similar transformations have been studied in the following oil fields; a) The crude oil migration in the Oued Beth fields has occurred without any notable alteration. b) At Chelif, in an outcrop, malthes and asphalts proceeding from a crude oil may be found. c) On the Bastennes diapyr, asphalts and crude oils appear. d) At Pechelbronn, in a fractured zone some crude oil is transformed into malthes and asphalts. Authors' Abstract

Fisk, H. N. SAND FACIES OF RECENT MISSISSIPPI DELTA DEPOSITS. Proc. Fourth World Petroleum Cong., Sec. I, 377-398 (I/C, Paper 4) Rome, (1955) June.

Major sand bodies in the Recent deltaic deposits of the Mississippi River include widespread delta-front sheet sands, delta-margin island and bar deposits, bar fingers, channel fillings, and abandoned beaches or cheniers. Each of these sand units compacted underlying silts and clays during deposition and settled into them, developing a thickness far greater than the depth of water in its depositional environment. Patterns of distribution and thickness trends of the various sand bodies were established by the direction of delta growth and bear no consistent relationship to the structure of the gulf basin. Bar fingers and channel fillings extend basinward at various angles to the regional strike, and chenier deposits parallel it. Deltaic sand facies do not rest upon significant erosional unconformities as do deposits of transgressive seas, such as barrier island sands. They grade laterally and vertically into surrounding facies and pinch out basinward within a seaward-thickening wedge of silty clays. Similar sand bodies in older rocks form petroleum reservoirs, and facies relationships in the Mississippi delta complexes provide guides for interpreting the environmental conditions under which such sand deposits developed and for predicting their trends. Author's Abstract

Fothergill, C. A. THE CEMENTATION OF OIL RESERVOIR SANDS AND ITS ORIGIN. Proc. Fourth World Petroleum Cong., Sec. I, 301-314 (I/B, Paper 1) Rome, (1955) June.

An investigation of the mineral cementation of oil reservoir sands from Venezuela has shown that there are marked patterns of cement development in lenticular sands within a sand-shale series. A number of different cements,

whose sequence can be established have been introduced into the sands as a result of post-depositional sedimentary processes, and it can be shown that, in respect of the carbonate cements (calcite, dolomite, and ferro-dolomite) there is a marked increase in cement content vertically toward sand/shale contacts, and there is evidence of a tendency towards an increase of cementation near the feather-edges of the lenses. A physico-chemical mechanism involving ionic impedance across shale barriers during the compaction phase is proposed to account for these patterns of cement development and evidence for this is presented. Inasmuch as the introduction of cement into a reservoir sand modifies its primary porosity and may alter appreciably its permeability, the role of cementation in oil geology is of both fundamental and practical importance, especially with regard to migration and the storage of oil in lenticular sands. Author's Abstract

Sloss, L. L. LOCATION OF PETROLEUM ACCUMULATION BY FACIES STUDIES. Proc. Fourth World Petroleum Cong., Sec. I, 315-335 (I/B, Paper 2) Rome, (1955) June.

Facies are treated as lateral or areal variations in the aspect of stratigraphic units. Analysis of sedimentary data from outcrops, cuttings and cores, and mechanical logs makes possible the derivation and numerical expression of a number of sedimentary aspects and the construction of a variety of quantitative facies maps. Certain sedimentary aspects yield facies maps which may be directly interpreted in terms of possible oil accumulation while the mapping of other aspects leads to a greater understanding of a particular area, and, indirectly, to an estimate of petroleum potentialities. Facies studies in oil exploration may be considered at four levels, each succeeding level of analysis bringing to bear a greater concentration of data and an increased attention to detail; 1. Regional studies, involving entire depositional provinces or parts of neighboring provinces; 2. Semi-regional, or "basin" studies, directed toward the estimate of possibilities of extension of productive trends within a single sedimentary basis; 3. district studies, designed for the development of new pools or the discovery of untapped potential zones within oil-producing areas; 4. pool studies which apply the great wealth of available data to the expansion of known oil pools or the discovery of further accumulations, particularly where non-structural traps are involved.

Author's Abstract

Smith, P. V., Jr. STATUS OF OUR PRESENT INFORMATION ON THE ORIGIN AND ACCUMULATION OF OIL. Proc. Fourth World Petroleum Cong., Sec. I, 359-376 (I/C Paper 2) Rome, (1955) June.

In past years, theorizing on the origin of petroleum has been influenced greatly by the fact that liquid hydrocarbons had never been detected in recent sediments. It has been widely proposed that petroleum was formed from the original "complex organic matter" through such agencies as bacteria, radioactivity, catalysis by the sediments, and possibly heat or pressure over indeterminate periods of time. In order to learn about the nature of the organic matter in recent sediments, a wide variety of fresh, brackish, and salt water deposits have been studied. In every case, paraffinic, naphthentic, and aromatic hydrocarbons have been detected. The quantities of such materials have varied from as little as 9 parts to as much as 11,700 parts per million of dried sediment. An estimate of 10,400,000 barrels of crude oil per cubic mile of sediments was obtained for a location off the coast of Louisiana by extrapolating core data, even though sediments in this area are characterized by relatively low organic carbon contents. Carbon 14 analysis have established the recent origin of these hydrocarbons. Possible sources of this "young petroleum" are discussed. Author's Abstract

VonEngelhardt, W. INTERSTITIAL WATER OF OIL BEARING SANDS AND SANDSTONES. Proc. Fourth World Petroleum Cong., Sec. VII, 399-416 (I/D, Paper 1) Rome, (1955) June.

The irreducible water saturation in beds of glass spheres, as obtained in the capillary pressure cell with different inter-facial tensions, contact angles and specific gravity differences is investigated theoretically and by experiments. The true capillary pressure function is calculated for pendular water rings at the contacts of spheres. In natural sandstones pendular water at grain contacts and water films on the inner rock surface are distinguished. The dependence of these two kinds of irreducible

water on the nature of displacing fluid is discussed. The possibility of transport phenomena in the water films as viscous flow, electrical conductivity and diffusion is investigated.

Author's Abstract

Petroleum Formation

Gussow, W. C. TIME, ACCUMULATION AND EVOLUTION OF HYDROCARBONS. *World Oil*, 143, 113-15 (1956) September.

The processes involved in hydrocarbon formation, mechanics of fluid movement through formations, and the influence of bacteria on the formation and conversion of petroleum are described briefly. This article is the second in a Distinguished Lecture series sponsored by the American Association of Petroleum Geologists.

B. E. Eakin

Shale Oil

DiRicco, L. and Barrick, P. L. PYROLYSIS OF OIL SHALE. *Ind. Eng. Chem.*, 48, 1316-19 (1956) August.

Ground oil shale was retorted in a fluidized system at reduced pressures to determine rates of pyrolysis at 250° to 465°C and 625 to 50 mm. Hg (absolute). First order rate constants were calculated.

E. B. Shultz, Jr.

Sulfur Problem

Sittig, M. and Unzelman, G. H. SULFUR IN GASOLINE: AN ECONOMIC APPRAISAL. *Petrol. Processing*, 11, 75-95 (1956) August.

Major topics of this extensive review of the subject are why sulfur should be removed, what forms it appears in, where it is found, how it can be reduced, and % of removal, U. S. pool gasoline information, application to the individual refiner's pool, sources of hydrogen for removal, economics of removal, and references.

D. M. Mason

7. ANALYTICAL METHODS AND TESTS

Chromatography

Dudenbostel, B. F., Jr. and Priestley, W. Jr. GAS CHROMATOGRAPHY FOR PROCESS CONTROL. *Ind. Eng. Chem.*, 48, 55A, 56 (1956) September.

A description of a chromatographic unit for process control under refinery plant conditions. A gas-solid adsorption column is used with instrument air being utilized as the carrier gas. Sampling is accomplished through the use of commercially available solenoid valves.

P. V. Burket

Greene, S. A., Moberg, M. L., and Wilson, E. M. SEPARATION OF GASES BY GAS ADSORPTION CHROMATOGRAPHY. *Anal Chem.*, 28, 1369-70, (1956) September.

A method for analyzing gas mixtures with wide boiling-point ranges by using a gas adsorption column whose temperature is constantly increased. An increase in speed of analysis as well as improved readability of results are obtained by this method.

P. V. Burket

Lewis, J. S., Patton, H. W. and Kaye, W. I. QUALITATIVE GAS CHROMATOGRAPHIC ANALYSIS USING TWO COLUMNS OF DIFFERENT CHARACTERISTICS. *Anal. Chem.*, 28, 1370-73 (1956) September.

A qualitative chromatographic technique is described by using two columns with different separate characteristics. A plot of elution time from one column against elution time from the other gives a good qualitative check. A synthetic unknown containing four different homologous series was used as a usefulness check with very good results.

P. V. Burket

Cr-V in Catalysts

Hiett, T. A. and Kobetz, P. DETERMINATION OF CHROMIUM AND VANADIUM IN SILICA-ALUMINA CRACKING CATALYST. *Anal. Chem.*, 28, 1495-7 (1956) September.

A rapid and accurate wet chemical method for the determination of small amounts of chromium and vanadium in silica-alumina cracking catalyst and similar materials involves amperometric titration with ferrous iron to determine chromium plus vanadium. Vanadium is titrated directly after reoxidation with potassium permanganate, followed by selective reduction of chromium with sodium azide. Chromium is calculated by difference. The precision varies from within ±0.0003% for less than 0.005 weight % to ±1% of the mean for greater than 0.10 weight %.

Authors' Abstract

Gas Infrared Spectra

Pierson, R. H., Fletcher, A. N., and Gantz, E. St. C. CATALOG OF INFRARED SPECTRA FOR QUALITATIVE ANALYSIS OF GASES. *Anal. Chem.*, 28, 1218-39, August (1956).

The infrared spectra of 66 gases and vapors

is given, together with a chart which aids in the rapid identification of the constituents of an unknown sample. E. Mann

Hydrocarbons in Soil

Huckabay, W. B. (assigned to Socony Mobil Oil Co., Inc.) METHOD OF ANALYZING EARTH MATERIALS FOR HYDROCARBONS. U. S. 2,733,135 (1956) January 31.

A method for analyzing soil samples and well cores is disclosed wherein the samples is treated with a solvent which dissolves hydrocarbons and which has a greater affinity for being adsorbed on the sample surfaces than the paraffin hydrocarbons desired to be separated, but a lesser affinity than other constituents of the soil sample. The extract solution is subjected to chromatographic (adsorption) separation to obtain the paraffin hydrocarbons only, which are then determined by suitable means.

D. M. Mason

Hydrocarbon Spectrometry

Field, F. H. and Hastings, S. H. DETERMINATION OF UNSATURATED HYDROCARBONS BY LOW VOLTAGE MASS SPECTROMETRY. *Anal. Chem.*, 28, 1248-55 (1956) August.

A method of determining unsaturates in petroleum naphthas gives quantitative information concerning the compound types present and the compounds belonging to these types. Interference from paraffins and naphthenes is negligible. The analysis is performed with a mass spectrometer operated with the ionizing voltage adjusted to form only the molecule ions of the unsaturates in the sample analyzed. The method is applicable to the analysis of catalytic cracked naphthas, virgin naphthas and hydroformates, and propylene polymers. Authors' Abstract

Metal Traces

Work, P. L. and Juliard, A. L. RAPID DETERMINATION OF METALS IN ORGANIC PRODUCTS WITH ALUMINA AS SPECTROGRAPHIC AID. *Anal. Chem.*, 28, 1261-64, August (1956).

The method described can be applied to the quantitative analysis of many metals in organic products of unknown composition. Alumina acts simultaneously as an ashing catalyst, ash collector and as a spectrographic carrier in the method described. The accuracy is within a few percent of the amount present. R. R. Amrine

Organic Sulfur

Coleman, H. J., Adams, N. G., Eccleston, B. H., Hopkins, R. L., Mikkelsen, L., Rall, H. T., Richardson, D., Thompson, C. J., and Smith, H. M. ANALYTICAL SEPARATION AND IDENTIFICATION OF SULFUR COMPOUNDS IN A PETROLEUM DISTILLATE BOILING TO 100° C. *Anal. Chem.*, 28, 1380-4 (1956) September.

The object of the work reported was to identify and quantitatively determine the sulfur compounds present in a crude oil in the boiling range 0° to 100° C. A naphtha was isothermally distilled from Wasson, Tex., crude oil to avoid thermal degradation and by adsorption and distillation processes and infrared examination of the final fractions the following compounds were identified: methanethiol, ethanethiol, 2-thiapropane, 2-propanethiol, 2-methyl-2-propanethiol, 2-thiabutane, 1-propanethiol, 3-methyl-2-thiabutane, 2-butanethiol, 2-methyl-1-propanethiol, 3-thiapentane, 2-thiapentane, 1-butanethiol, 3,3-dimethyl-2-thiabutane, and 2-methyl-2-butanethiol. Thiophene was not found, although repeated tests were made for this compound. Knowledge of the sulfur compounds and their concentration in crude oil is of considerable theoretical interest and should aid in refining processes. Authors' Abstract

Thompson, C. J., Coleman, H. J., Mikkelsen, L., Yee, D., Ward, C. C., and Rall, H. T. IDENTIFICATION OF THIOPHENE AND 2-METHYLTHIOPHENE IN VIRGIN PETROLEUM. *Anal. Chem.*, 28, 1384-7 (1956) Sept.

Whether thiophene as such exists in virgin petroleum or is produced by pyrolytic breakdown or rearrangement of other sulfur compounds has been of interest to petroleum chemists for many years. This paper discusses the concentration and spectroscopic identification of thiophene and 2-methyl-thiophene in a Wilmington, Calif., crude oil. The crude oil was exposed to a maximum temperature of only 100° C. for less than 30 seconds in the preparation of the distillate from which the thiophene was concentrated. The knowledge that thiophene exists in petroleum is of importance not only to the practical chemist interest in the removal of sulfur compounds from petroleum

distillates, but also to the fundamental chemist and geologist who are concerned with the origin of petroleum and of the sulfur compounds found in it. D. M. Mason

Volumetric C-H

Christman, D. R., Stuber, J. E., and Bothner-By, A. A. DRY COMBUSTION AND VOLUMETRIC DETERMINATION OF ISOTOPIC CARBON AND HYDROGEN IN ORGANIC COMPOUNDS. *Anal. Chem.*, 28, 1345-7 (1956) August.

Small amounts of nitrogen dioxide in the presence of excess oxygen will pass through a dry-ice-cooled radiator trap at low pressures, making possible the freezing out of water before the removal of nitrogen dioxide by external means during the dry combustion of organic compounds. In applying a temperature correction to the gas pressure measurements of carbon dioxide and water by means of a two-liquid manometer, an empirical correction of greater magnitude (about 0.5% per degree) than that calculated by means of the gas law gives the most consistent results. Authors' Absract

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorbed Water

Zimmerman, J. R., Holmes, B. G. and Lasater, J. A. A STUDY OF ADSORBED WATER ON SILICA GEL BY NUCLEAR RESONANCE TECHNIQUES. *J. Phys. Chem.*, 60, 1157-61 (1956) September.

Nuclear magnetic resonance measurements have been obtained from the hydrogen nuclei of H_2O adsorbed on silica gel by means of pulsed radio frequency techniques. The experimental data are values of T_2, the inverse line width parameter, as a function of adsorbed water vapor coverage on the silica gel. Insofar as nuclear relaxation time (T_2) is concerned, a twofold phase system is observed at large surface coverage which presumably distinguishes between protons in the water adsorbed in and adsorbed on the monomolecular layer. At low surface coverages, Θ is less than 0.5, the measurements point out the existence of two discrete adsorption energy sites. The relaxation data pertaining to the lower energy sites at this low surface coverage strongly suggest that the relaxation effects due to interactions between adsorbed water molecules have been directly observed. A qualitative comparison of these experimental results is made with dielectric measurements obtained by Kurosaki. Where two-phase systems exist, some sample quantitative measurements of the relative number of water molecules associated with each adsorption phase are given. Authors' Abstract

Catalysis

Maxted, E. B. and Josephs, M. STUDIES OF THE STRENGTH OF POISON-TO-CATALYST BONDS. PART I. HEATS OF ADSORPTION OF ETHYL SULFIDE AND THIOPHEN ON PLATINUM. *J. Chem. Soc.* (British), 2635-39 (1956) August.

The differential heat of adsorption of diethyl sulfide and of thiophene on platinum has been studied at temperatures at which this adsorption is reversible. Values for the initial adsorption heat of 65-70 Kcal. per mole for ethyl sulfide, and of about 33 kcal. for thiophene, have been obtained. Thiophene, unlike ethyl sulfide, is known to be stabilised by a resonance energy of about 31 kcal.; and this observed difference of about 35 kcal. in the respective adsorption heats, which is of the same order as the resonance energy of thiophene, may support the view that thiophene, on its adsorption on platinum, loses its resonance structure, as has also been suggested for benzene.

Authors' Abstract

ADVANCES IN CATALYSIS. *World Petrol.*, 27, 66-67 (1956) September.

The International Congress on Catalysis held in Philadelphia from September 10-14, was attended by about 700 scientists from the United States, Canada and 23 countries of Europe and Asia. A total of 78 papers were presented and discussed at the Congress, about half of which were written by scientists from abroad. All papers had been preprinted to facilitate discussion and complete proceedings of the Congress will be published by Academic Press, Inc. as a volume in the Series "Advances in Catalysis". All papers were organized into four major symposia with many subdivisions: 1) Chemistry and Physics of Solid Catalysts, 2) Homogenous Catalysis and Related Effects, 3) Surface Chemistry and Its Relation to Catalysis, 4) Techniques and Technology of Catalysis.

Authors' Abstract

Heats of Combustion

Handrick, G. R. HEATS OF COMBUSTION OF ORGANIC COMPOUNDS. *Ind. Eng. Chem.*, 48, 1366-74 (1956) August.

A new method for calculating heats of combustion of organic compounds is based on the straight-line relation between molar oxygen balance and molar heat of combustion. It serves as a simplified system for estimating a thermochemical property and for checking the accuracy of new values assigned as contributions of functional groups to heat of combustion. It may be applied to choosing tailor-made compounds with specific energy features, which should be particularly helpful in the field of explosives. Author's Abstract

Young, J. A., Keith, J. E., Stehle, P., Dzombak, W. C., and Hunt, H. HEATS OF COMBUSTION OF SOME ORGANIC NITROGEN COMPOUNDS. *Ind. Eng. Chem.*, 48, 1375-82 (1956) August.

A simple linear relationship is suggested, which should be useful in predicting the heats of combustion of various types of organic compounds. The method is based on the number of oxygen atoms necessary to burn the compound to carbon dioxide, water and nitrogen. The mathematical relationships are convenient to solve, and the equations presented will give a fairly accurate estimate of combustion. Authors' Abstract

Hydrogen Persulfides

Meissner, H. P., Conway, E. R., and Mickley, H. S. SYNTHESIS OF HYDROGEN PERSULFIDES. *Ind. Eng. Chem.*, 48, 1347-60 (1956) August.

This report gives data on the first quantitative examination of the variables involved in preparing hydrogen persulfides from an inorganic polysulfide and an inorganic acid. Authors' Abstract

Ion Exchange

Arden, T. V. LABORATORY APPLICATIONS OF ION EXCHANGE RESINS* PART VI: INDUSTRIAL DEVELOPMENTS. *Lab Practice*, 5, 294-7 (1956) August.

Industrial ion exchange processes for purification of wine, recovery of streptomycin and extraction of uranium are described. Use of membranes for production of sulfuric acid from dilute metal sulfate solutions, and for desalting sea water are discussed. D. M. Mason

Mixed Alkanes

Van der Waals, J. H. THERMODYNAMIC PROPERTIES OF SOME BINARY ALKANE MIXTURES AT CONSTANT VOLUME. *Faraday Soc. Trans.* (British), 52, 916-25 (1956) July.

Results are presented of the calculation of the energy and excess entropy of mixing for binary mixtures of n-alkanes of different chain length for existing statistical theories, and by utilizing experimental data. Agreement is fair for the theoretical energy of mixing, but the experimentally determined entropy of mixing is considerably higher than those predicted by current theory. B. E. Eakin

Permeability

Frisch, H. L. GAS PERMEATION THROUGH MEMBRANES DUE TO SIMULTANEOUS DIFFUSION AND CONVECTION. *J. Phys. Chem.*, 60, 1177-81 (1956) September.

The theory of gas permeation by simultaneous diffusion and convection through membranes possessing pores or channels is developed particularly in reference to gas transmission measurements through polymer films. Considerable simplification is obtained when the gas dissolved in the membrane matrix is in equilibrium across an interface with the gas in the channels (solution equilibrium). This state is generally attained rapidly. Measurements of the rate of gas transmission, particularly the time lag, under various applied pressure gradients can be shown to yield, besides the value of the diffusion constant, the gas solubility, the specific convection velocity of the gas as well as other parameters characteristic of the permeation mechanism, information concerning the membrane porosity (and thus something of the structure). The effect of the absence of solution equilibrium is investigated and the magnitude of such an effect is estimated. The temperature dependence of the convective contribution to the permeability coefficient is derived. Authors' Abstract

9. ORGANIC CHEMISTRY

Acetylene Separation

Benedek, P. and Szepesy, L. GEWINNUNG VON REINEM ACETYLEN AUS GASGEMISCHEN MIT NIEDRIGEM ACETYLENGEHALT DURCH KONTINUIERLICHE GASCHROMATOGRAPHIE. (PRODUCTION OF PURE ACETYLENE FROM A MIXTURE OF GASES WITH LOW ACETYLENE CONTENT BY CONTINUOUS GAS CHROMATOGRAPHY.) *Erdoel und Kohle* (German) **9**, 593-97 (1956) September.

The important factors of continuous gas chromatography for the separation of the end gases of the partial methane oxidation have been determined. The measurements in the pilot plant agreed with the calculations made in the laboratory for the use of the gas chromatography column. Other important experience with respect to the use of this new technology of gas separation was obtained and can be applied to other problems in the field of industrial gases. G. Kunst

Canadian Expansion

Reidel, J. C. PETROCHEMICALS ARE ON THE MARCH IN CANADA. *Oil Gas J.*, **54**, 217 (1956) August.

A second round of expansion, following original postwar building of petro-chemical facilities, is now getting into swing. Activity is heavy in ammonia, expansion of hydrocarbon raw materials recovery, polyethylene, and in sulfur recovery. Other organic chemical derivatives facilities are being expanded.

Author's Abstract

Dealkylation

Silsby, R. I. and Sawyer, E. W. THE DEALKYLATION OF ALKYL AROMATIC HYDROCARBONS I: THE KINETICS AND MECHANISM OF TOLUENE DECOMPOSITION IN THE PRESENCE OF HYDROGEN. *J. Appl. Chem.* (British) **6**, 347-56 (1956) August.

It was found that the decomposition of toluene to benzene and methane in the presence of a large excess of hydrogen proceeds simply without the intervention of secondary, and further reactions. H. L. Feldkirchner

Ethylene

Kuhn, W. E. and Hutcheson, J. W. VERSATILE ETHYLENE. *Petrol. Processing*, **11**, 107-108 (1956) September.

The annual consumption of ethylene is expected to reach a value of 4,000,000,000 lb. by 1960. The expected growth of polyethylene consumption will be the greatest factor in the increased consumption of ethylene. H. L. Feldkirchner

Naphthalene

TWO WAYS TO GET NAPHTHALENE FROM PETROLEUM. *Chem. Week*, **79**, 60 (1956) August 25.

Naphthalene production by dealkylation of methyl naphthalene by hydrogenation and by concentration of the naphthalene present in refinery streams is discussed.

H. L. Feldkirchner

Phenol Synthesis

Toland, W. G., Jr. (assigned to California Research Corp.) PRODUCTION OF PHENOLS. U. S. 2,760,991 (1956) August 28.

A process for producing phenols is claimed in which aromatic hydrocarbons having at least one unsubstituted nuclear hydrogen atom are heated with copper sulfate and water to 350° to 700° F., under a pressure which maintains part of the water in liquid phase. Preferred water to hydrocarbon ratio is 25 to 75.

O. P. Brysch

Synthetic Nitrogen Compounds

Hatch, L. F. NITROGEN COMPOUNDS FROM PETROLEUM. *Petrol. Refiner*, **35**, 147-52 (1956) August.

Methods for synthesizing nitrogen-containing products from hydrocarbons and nitrogen compounds are given. In particular those compounds are discussed which may be produced by reaction between ammonia or nitric acid and a hydrocarbon. H. L. Feldkirchner

The following article, the abstract for which appears on the page indicated, is also called to your attention:
CONTINUOUS BENZOLE RECOVERY AND RECTIFICATION page 221

10. CHEMICAL ENGINEERING

Fluidized Drying

Parry, V. F. (assignor to the United States of America, Secretary of Interior). APPARATUS FOR DRYING SOLIDS IN A FLUIDIZED BED. U. S. 2,763,478 (1956) September 18.

In this process for drying oil shales, lignite and wet low-rank coals, the finely divided solid material is contacted with and entrained in a stream of hot combustion gases which have a temperature of 2000° to 3000° F.

E. J. Pyrcioch

Heat Flow

Paschkis, V. and Stolz, G., Jr. QUENCHING AS A HEAT TRANSFER PROBLEM. *J. Metals*, 8, 1074-5 (1956) August.

Boundary conductance—the heat transfer from the surface of a quenched object to the quenchant—largely defines hardness resulting from quenching, according to this first report on a cooperative project carried out in the Heat and Mass Flow Analyzer Laboratory at Columbia University. Authors' Abstract

Pilot Plant Cost

Boisture, W. W., Nicholson, E. W. S., Taff, W. O. ESSO IMPROVES PERFORMANCE AND COMBATS HIGH COSTS OF PILOT PLANT OPERATIONS. *Chem. Eng Progress*, 52, 329-31 (1956) August.

Engineers of Standard Oil Company (New Jersey) have been making concentrated effort to reduce the cost of the pilot plant phase of their new process developments. Annual meetings under the committee's sponsorship were held to discuss pilot plant problems. Summaries were prepared as a reference for the pilot plant engineer, equipment survey, cooperative design studies were recognized as a very important factor. Finally, personnel and communication was studied with the startling fact that an improvement in this field could save time, data and even equipment from being lost. A consultant in the field of communication was even called to serve as a guide to better performance.

G. Kunst

Reactor Operations

Chambre, P. L. ON THE CHARACTERISTICS OF A NON-ISOTHERMAL CHEMICAL REACTOR. *Chem. Eng. Science*, 5, 209-16, (1956) August.

The temperature and degree of conversion in a chemical reactor is analyzed by means of a mathematical model representing heat transfer and reaction rates. The general differential equation cannot be solved analytically; however by the choice of suitable parameters, any particular case of a non-isothermal chemical reaction can be solved numerically through the use of the isocline method. This method requires computation of slopes from the general differential equation, which slopes are plotted on graph paper, and then drawing the solution curve for any specific case through this direction field. Operational characteristics of reactors are discussed from the trends shown in the mathematical analysis.

C. G. von Fredersdorff

Friedman, S. H. HOW TO PICK HEAT FOR PILOT REACTOR. *Chem. Eng.*, 63, 217-20, August (1956).

For temperatures over 600° F., mercury, salts, and sodium potassium eutectics are used. Under 600° F., *Dowtherm*, *Aroclor*, and *S/V 600* are used. Detailed comparison of the properties of the materials for use under 600° F. are given.

W. G. Bair

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Control of Boilers

Holzbock, W. G. INSTRUMENTATION AND CONTROL OF BOILERS. *Air Condg., Heatg., and Ventg.* 53, 81-96 (1956) August.

A better understanding is provided concerning the various phases of instrumentation necessary to secure combustion control. The variables to be regulated may include steam pressure, steam flow, air flow and draft. Responses are designed into the control for specific action and regulation. Not only are the many actions described, but a large number of diagrams help clarify the information which the author has assembled.

Author's Abstract

Equipment Costs

Zimmerman, O. T. and Lavine, I. WANT EQUIPMENT COSTS FOR ESTIMATES? *Petrol. Refiner*, 35, 116-28 (1956) August.

Costs of eleven types of process equipment are

given on graphs for making quick estimates of equipment costs. W. G. Bair

Test Meter

Horspool, J. M. and Littlejohn, R. J. USE OF A WET GAS METER IN A SAMPLING LINE OPERATING UNDER REDUCED PRESSURE. *Chem. and Ind.* (British) **35**, 915-916 (1956) Sept. 8.

An arrangement using a water aspirator to pump gas from a sample line operating under reduced pressure into a wet test meter is described. D. M. Mason

Thermocouple

Guettel, C. L. A NEW THERMOCOUPLE FOR SERVICE IN REDUCING ATMOSPHERES. *ASTM Bull.* **216**, 64-65 (1956) September.

This thermocouple of 2 nickel-chromium-silicon alloys (No. 242 and 33) gives much better results after extended periods in reducing atmospheres than do conventional thermocouples. P. V. Burket

Vacuum Pumps

Dobrowolski, Z. HIGH VACUUM PUMPS. *Chem. Eng.* **63**, 181-85 (1956) September.

The article outlines the different types of vacuum pumps, both mechanical and diffusion, available today. Recommended operating conditions for each type are discussed. W. G. Bair

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Reuter, G. and Schuermann, G. DIE WIRTSCHAFTLICHE AUSFUEHRUNG EINER KATHODISCHEN SCHUTZANLAGE MIT FREMDSTROM. (THE ECONOMICAL USE OF A PROTECTIVE CATHODIC ARRANGEMENT WITH FOREIGN CURRENT). *Gas- und Wasserfach* (German), **97**, 637-41 (1956) August 1.

Arrangements of cathodic protection for pipelines and other underground equipment can be a financial burden, therefore an exact estimation must precede. Such a precalculation and estimation is presented here after a thorough consideration and investigation. It is also shown in these sample calculations that one cannot proceed in a schematical way in such a case. G. Kunst

Coatings

Brand, B. G. Fink, F. W., and Mueller, E. R. ORGANIC COATINGS USED IN CATHODICALLY PROTECTED DOMESTIC HOT WATER TANKS. *Ind. Finishing* (British), **9**, 51-53 (1956) August.

The Battelle Memorial Institute initiated a program to determine the possibility of using organic coatings on interiors of hot water tanks cathodically protected with magnesium anodes. The coatings selected for tests were known to have good resistance in hot water tanks. They were exposed to thermal shock tests, alkali resistance, applied potential test and magnesium anode test. The result of these tests offered promise for epoxy-phenolic resins; the blistering of these coatings in a cathodic environment did not seem to be affecting the electrical resistance of the films, but there was an indication that the blistering was progressive with time. In the magnesium anode test it was shown that there is a good possibility of using organic coatings to advantage. G. Kunst

Elm, A. C. COATINGS FOR USE WITH CATHODIC PROTECTION. *Paint and Varnish*, **46**, 27-30, 98 (1956) August.

Organic protective coatings when employed with cathodic protection are subject to electrolytic influences which tend to promote certain film failures. Foremost among these is blistering. The blistering occurs primarily over cathodic areas and is believed to be the consequence of the endosmotic transfer of water to the cathode surface coupled with the formation of alkali. It was suggested in order to avoid blistering one should make the paint film a part of the electronic branch of the corrosion circuit thus moving the cathode surface to the coating surface. It was suggested that zinc-rich paints might be well suited for use with cathodic protection and research be undertaken along these lines. G. Kunst

Hydrogen Attack

Williams, B. G. HYDROGEN ATTACK ON MILD STEEL EQUIPMENT. *Petroleum* (British) **19**, 320-6 (1956) September.

The advantages of low-hydrogen electrodes for

applications using mild steel are outlined in this paper with particular reference to the problems of embrittlement. The author also discusses the general principles of the problem of hydrogen embrittlement. The first part of this paper, which dealt with hydrogen blistering, appeared in July. Author's Abstract

Inhibitors

Jones, L. W., and Barrett, J. P. NEW INHIBITOR SAFEGUARDS VAPOR SPACES AGAINST H_2S CORROSION. *Oil Gas J.*, 54, 132-34, 136-37 (1956) September 24.

Volatile inhibitors offer an economical and convenient means of controlling hydrogen sulfide corrosion in the vapor spaces of oil-well casings, storage tanks and similar equipment. A group of low-molecular-weight aliphatic amines have been found to be well suited for this purpose. One of these, diethylamine, is now in widespread field use. Its advantages are: gives good corrosion inhibition in concentrations as low as 50 p.p.m.; is completely miscible with oil or water; vaporizes readily, but can be handled without elaborate equipment. Authors' Abstract

Nonferrous Metals

Gela, T., Lepkowski, W. J. and Gade, H. M. HOW 7 NONFERROUS METALS PERFORM AT LOW TEMPERATURES. *Materials and Methods*, 44, 116-20 (1956) September.

Problems encountered with steels at low temperatures have been well publicized, but what happens to other metals when temperatures drop as low as —100° F.? Here are the results of tensile, fatigue and impact tests.

Authors' Abstract

Plastic Pipe

Bogan, R. T. PLASTIC PIPE. *Materials and Methods*, 44, 100-4 (1956) August.

Pipe is now a major application for plastic materials. In general, plastic has the following advantage over metal pipe: 1) resistance to electrolytic attack, 2) light weight and flexibility, 3) minimal solid collection resulting in low frictional losses and turbulence of flow. Major limitations are: 1) poor temperature resistance, 2) high cost due to basic resin. Six major types of plastics are compared with metal with respect to cost, chemical resistance, physical properties and design considerations.

G. Kunst

13. NEW BOOKS

(C. A. Simms, Librarian)

Analytical Methods

Belcher, R. and Wilson, C. L. NEW METHODS IN ANALYTICAL CHEMISTRY. New York: Reinhold Publishing Corp., 1956.

New developments since 1932 in the field of classical methods for inorganic analysis are described in this book. Approximately 100 items (precipitations, gravimetric and titrimetric determinations, etc.) are discussed under the following chapter headings: I. Separation by Precipitation; II. Separation by Extraction; III. Inorganic Precipitants, Organic Reagents; IV. Indicators, VI. Titrants; VII. Miscellaneous Methods. For example, 6 new methods for sulfate, 9 new methods for calcium, and 5 new indicators for iodimetric titration are described.

D. M. Mason

Appliance Industry

European Productivity Agency. COOKING AND HEATING APPLIANCES IN THE USA: PRODUCTION AND DISTRIBUTION. Project No. 246. Paris, O.E.E.C. (1956) September.

This 74-page report covers the findings of representatives from West Europe and Mediterranean countries whose mission toured U.S. industry in 1954. The aims of the mission were as follows: "to study American domestic heating and cooking appliances with a view to raising productivity in the manufacture of this category of widely used durable goods; to disseminate in Europe a knowledge of the characteristics of the corresponding industry in America: structure of the industry, structure of industrial undertakings, manufacturing methods, financing and organisation of research, price policy, distribution channels, relations with customers, role of trade associations, technical and general problems (importance of human relations in the undertakings concerned)." R. T. Ellington

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Bituminous Coal Research Reports
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British Coal Utilization Research Association
Monthly Bulletin and Quarterly Gazette
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California Oil World
Canadian Chemical Processing
Canadian Gas Journal
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Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins,
Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
Lubrication

Materials and Methods
Mathematical Aids
Mechanical Engineering
Mining Engineering

National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics Today
Pipe Line Industry
Power
Producers Monthly
Public Utilities Fortnightly

Refrigerating Engineering
Review of Scientific Instruments
Revue Generale du Gaz
Rivista dei Combustibili

Science
Svenska Gasverksföreningens Månadsblad

U.S. Bureau of Mines, Bulletins, Information Circulars,
Reports of Investigations and Technical Papers

World Oil
World Petroleum

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY